

**COMBINED THERMAL AND CATALYTIC  
TREATMENT OF HEAVY PETROLEUM IN A SLURRY  
PHASE COUNTERFLOW REACTOR**

**ABSTRACT OF THE DISCLOSURE**

A slurry phase reactor is designed to treat extra heavy petroleum crude in a combination of thermal-zone and catalytic-zone in a counterflow system where liquid feed is added to the top and hydrogen at the bottom. Feed enters the gas-phase thermal zone, where it passes to a liquid-phase thermal zone. In the liquid-phase thermal zone, the hydrocarbon is thermally cracked and the unreacted liquid is further passed to a catalytic-zone below in communication with the thermal-zone. Catalyst can be added or removed as required in a continuous mode without shutting down the system. The heat generated inside the catalytic cracking zone is distributed to the entire reactor as the gaseous product flows upward. Feed is brought to the reaction conditions by the heat recovered from the gas-phase zone. Reaction temperature could be controlled by feed temperature.